

[10191/2374]

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s) : Peter SCHRAMM et al.
Serial No. : To Be Assigned
Filed : Herewith
For : FUEL INJECTOR
Art Unit : To Be Assigned
Examiner : To Be Assigned

Assistant Commissioner for Patents
Washington, D.C. 20231

**PRELIMINARY AMENDMENT AND
37 C.F.R. § 1.125 SUBSTITUTE SPECIFICATION STATEMENT**

SIR:

Please amend the above-identified application before examination, as set forth below.

IN THE SPECIFICATION AND ABSTRACT:

In accordance with 37 C.F.R. § 1.121(b)(3), a Substitute Specification (including the Abstract, but without claims) accompanies this response. It is respectfully requested that the Substitute Specification (including Abstract) be entered to replace the Specification of record.

IN THE CLAIMS:

Please cancel claims 1-6 without prejudice.

Please add the following new claims:

7. (New) A fuel injector for direct injection of fuel into a combination chamber of an internal combustion engine, the fuel injector comprising:

a nozzle body; and

at least one retaining flange situated on the nozzle body and projecting radially beyond the nozzle body, the at least one retaining flange having a working surface for a hold-down device and a seating surface for positioning on a cylinder head of the

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engine, the at least one retaining flange extending over only a portion of a periphery of the fuel injector.

8. (New) The fuel injector according to claim 7, wherein the at least one retaining flange includes two retaining flanges situated opposite one another.

9. (New) The fuel injector according to claim 8, wherein the retaining flanges are made as separate components and are joined to the nozzle body in one of an integral and a friction-locking manner.

10. (New) The fuel injector according to claim 9, wherein the retaining flanges are welded to the nozzle body.

11. (New) The fuel injector according to claim 8, wherein each of the retaining flanges is made in one piece with the nozzle body.

12. (New) The fuel injector according to claim 8, wherein each of the retaining flanges covers an angular range of about 45° in a peripheral direction.

Remarks

This Preliminary Amendment cancels without prejudice original claims 1-6 in the underlying PCT Application No. PCT/DE01/02711, and adds without prejudice new claims 7-12. The new claims conform the claims to U.S. Patent and Trademark Office rules and do not add new matter to the application.

In accordance with 37 C.F.R. § 1.121(b)(3), the Substitute Specification (including the Abstract, but without the claims) contains no new matter. The amendments reflected in the Substitute Specification (including Abstract) are to conform the Specification and Abstract to U.S. Patent and Trademark Office rules or to correct informalities. As required by 37 C.F.R. § 1.121(b)(3)(iii) and § 1.125(b)(2), a Marked Up Version Of The Substitute Specification comparing the Specification of record and the Substitute Specification also accompanies this Preliminary Amendment. Approval and entry of the Substitute Specification (including Abstract) is respectfully requested.

The underlying PCT Application No. PCT/DE01/02711 includes an International Search Report, dated January 3, 2002. The Search Report includes a list of documents that were uncovered in the underlying PCT Application. A copy of the Search Report accompanies this Preliminary Amendment.

Applicants assert that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully Submitted,

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By  9
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Dated: 4/4/02

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FUEL INJECTOR

Background Information

[The present invention relates to a fuel injector according to the preamble of Claim 1.
][Unexamined] Japanese Patent Application No. 08-312503 [A] describes a fuel
injector having a peripheral collar, the bottom of which may be placed on the top of
the cylinder head. The fuel injector may be held in a receptacle bore by a hold-down
device against a relatively high combustion pressure prevailing in a combustion
chamber of the internal combustion engine. The hold-down acts on the collar at two
opposing locations on the periphery of the fuel injector.

One disadvantage of this fuel injector is that a slim, compact design of the fuel
injector is impossible, because the peripheral collar requires a great width of the fuel
injector.

German Patent No. 44 13 415 [C1] describes a fuel injector having seating surfaces
for a hold-down device in diametrically opposed positions, not distributed over the
entire periphery of the nozzle body of the fuel injector. These seating surfaces are
formed by recesses in the nozzle body. Therefore, the seating surfaces are inside
the periphery of the nozzle body radially.

One disadvantage of this fuel injector according to the related art is that the
hold-down forces transmitted to the seating surfaces are supported by the nozzle
body.

German Patent Application No. 197 35 665 A1 also describes a fuel injector having
a collar on which a hold-down device acts. A cylinder head has a recess in which the
collar of the fuel injector is situated, so that the collar of the fuel injector, acted upon

MARKED-UP VERSION OF SUBSTITUTE SPECIFICATION

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by the hold-down device is countersunk in the cylinder head. This fuel injector also does not have a compact design.

[Advantages of the] Summary Of The Invention

- 5 The fuel injector according to the present invention [having the features of Claim 1] has the advantage over the related art that it permits a slim, compact design of the fuel injector and at the same time allows the hold-down forces to be dissipated without transmitting these forces through the nozzle body.
- 10 [Advantageous refinements of the fuel injector characterized in Claim 1 are possible through the measures characterized in the subclaims.]

Drawing

- 15 An embodiment of the present invention is illustrated in the drawing and explained in greater detail in the following description.] Brief Description Of The Drawings
- Figure 1 shows a partial side view of an embodiment of a fuel injector according to the present invention[, and].

- 20 Figure 2 shows a top view of the embodiment of a fuel injector according to the present invention, illustrated in Figure 1.

Detailed Description [of the Exemplary Embodiment]

- Figure 1 shows a fuel injector 1, showing only the section at the inlet end. Fuel
- 25 injector 1 has a nozzle body 2 and an inlet connection 3 on its inlet end. A sealing ring 4, shown here in a sectional view, seals inlet connection 3 from a fuel inlet (not shown). Retaining flanges 5 which project radially beyond nozzle body 2 and on which a hold-down device may act on a working surface 6 of retaining flanges 5 are situated on nozzle body 2. Retaining flanges 5 may rest on a seating surface 7 of a
- 30 cylinder head of an internal combustion engine, for example. According to the

present invention, retaining flanges 5 extend over only a portion of the periphery of nozzle body 2.

Figure 2 shows a top view of fuel injector 1 according to the present invention from Figure 1. Inlet connection 3 is located upstream from nozzle body 2. Sealing ring 4 is mostly covered by inlet connection 3. An inlet bore 8 is situated centrally in inlet connection 3. In addition, a portion of a connector 9 which connects a controller to fuel injector 1, which has an energizable actuator. Two retaining flanges 5 are situated opposite one another on the periphery of nozzle body 2. Two retaining flanges 5 each take up an angle range of [approx.] approximately 45°, for example, in the peripheral direction. For example, connector 9 may extend at a distance of 90° from both retaining flanges 5. In the diagram shown here, of retaining flanges 5, only working surfaces 6 for a hold-down device are visible.

Fuel injector 1 is pressed by a tension claw of the hold-down device, which, pressed into a receptacle bore in the cylinder head, presses on working surfaces 6. Lower seating surfaces 7 rest on the cylinder head and support the hold-down force.

Therefore, it is possible for very high hold-down forces to be applied without them having to be diverted through nozzle body 2. Since retaining flanges 5 extend over only part of the periphery, fuel injector 1 has a very slim and compact design. Retaining flanges 5 may also be used to align fuel injector 1 with respect to the cylinder head and the combustion chamber.

Retaining flanges 5 may be separate parts which are joined by welding or in a force-locking or friction-locking manner (Figure 1) or they may be shaped in one piece with nozzle body 2 by removal of material, e.g., machining (Figure 2). Alternatively, retaining flanges 5 may be formed in one piece by reshaping from the material of nozzle body 2.

In particular, with fuel injector 1 according to the present invention, no additional component is necessary for attaching a tension claw, such as a pressure sleeve which is mounted on fuel injector 1. Through an appropriate design of the tension claw, fuel injector 1 may also be secured on retaining flanges 5 to prevent twisting in its receptacle bore.

Abstract Of The Disclosure

A fuel injector [(1)] for direct injection of fuel into a combustion chamber of an internal combustion engine has at least one retaining flange [(5)] situated on a nozzle body [(2)] of the fuel injector[(1)]. The retaining flange [(5)] projects radially above the nozzle body[(2)], and a hold-down device may act on it. The retaining flange [(5)] may rest on a cylinder head of the internal combustion engine. The retaining flanges [(5)] extend over only portions of the periphery of the nozzle body[(2)].

5 [(Figure 2)]

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FUEL INJECTOR

Background Information

Japanese Patent Application No. 08-312503 describes a fuel injector having a peripheral collar, the bottom of which may be placed on the top of the cylinder head. The fuel injector may be held in a receptacle bore by a hold-down device against a
5 relatively high combustion pressure prevailing in a combustion chamber of the internal combustion engine. The hold-down acts on the collar at two opposing locations on the periphery of the fuel injector.

One disadvantage of this fuel injector is that a slim, compact design of the fuel
10 injector is impossible, because the peripheral collar requires a great width of the fuel injector.

German Patent No. 44 13 415 describes a fuel injector having seating surfaces for a hold-down device in diametrically opposed positions, not distributed over the entire
15 periphery of the nozzle body of the fuel injector. These seating surfaces are formed by recesses in the nozzle body. Therefore, the seating surfaces are inside the periphery of the nozzle body radially.

One disadvantage of this fuel injector according to the related art is that the hold-
20 down forces transmitted to the seating surfaces are supported by the nozzle body.

German Patent Application No. 197 35 665 A1 also describes a fuel injector having a collar on which a hold-down device acts. A cylinder head has a recess in which the collar of the fuel injector is situated, so that the collar of the fuel injector, acted upon
25 by the hold-down device is countersunk in the cylinder head. This fuel injector also does not have a compact design.

SUBSTITUTE SPECIFICATION

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Summary Of The Invention

The fuel injector according to the present invention has the advantage over the related art that it permits a slim, compact design of the fuel injector and at the same time allows the hold-down forces to be dissipated without transmitting these forces through the nozzle body.

Brief Description Of The Drawings

Figure 1 shows a partial side view of an embodiment of a fuel injector according to the present invention.

Figure 2 shows a top view of the embodiment of a fuel injector according to the present invention, illustrated in Figure 1.

Detailed Description

Figure 1 shows a fuel injector 1, showing only the section at the inlet end. Fuel injector 1 has a nozzle body 2 and an inlet connection 3 on its inlet end. A sealing ring 4, shown here in a sectional view, seals inlet connection 3 from a fuel inlet (not shown). Retaining flanges 5 which project radially beyond nozzle body 2 and on which a hold-down device may act on a working surface 6 of retaining flanges 5 are situated on nozzle body 2. Retaining flanges 5 may rest on a seating surface 7 of a cylinder head of an internal combustion engine, for example. According to the present invention, retaining flanges 5 extend over only a portion of the periphery of nozzle body 2.

Figure 2 shows a top view of fuel injector 1 according to the present invention from Figure 1. Inlet connection 3 is located upstream from nozzle body 2. Sealing ring 4 is mostly covered by inlet connection 3. An inlet bore 8 is situated centrally in inlet connection 3. In addition, a portion of a connector 9 which connects a controller to fuel injector 1, which has an energizable actuator. Two retaining flanges 5 are situated opposite one another on the periphery of nozzle body 2. Two retaining

flanges 5 each take up an angle range of approximately 45° , for example, in the peripheral direction. For example, connector 9 may extend at a distance of 90° from both retaining flanges 5. In the diagram shown here, of retaining flanges 5, only working surfaces 6 for a hold-down device are visible.

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Fuel injector 1 is pressed by a tension claw of the hold-down device, which, pressed into a receptacle bore in the cylinder head, presses on working surfaces 6. Lower seating surfaces 7 rest on the cylinder head and support the hold-down force.

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Therefore, it is possible for very high hold-down forces to be applied without them having to be diverted through nozzle body 2. Since retaining flanges 5 extend over only part of the periphery, fuel injector 1 has a very slim and compact design. Retaining flanges 5 may also be used to align fuel injector 1 with respect to the cylinder head and the combustion chamber.

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Retaining flanges 5 may be separate parts which are joined by welding or in a force-locking or friction-locking manner (Figure 1) or they may be shaped in one piece with nozzle body 2 by removal of material, e.g., machining (Figure 2). Alternatively, retaining flanges 5 may be formed in one piece by reshaping from the material of

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In particular, with fuel injector 1 according to the present invention, no additional component is necessary for attaching a tension claw, such as a pressure sleeve which is mounted on fuel injector 1. Through an appropriate design of the tension

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claw, fuel injector 1 may also be secured on retaining flanges 5 to prevent twisting in its receptacle bore.

Abstract Of The Disclosure

A fuel injector for direct injection of fuel into a combustion chamber of an internal combustion engine has at least one retaining flange situated on a nozzle body of the fuel injector. The retaining flange projects radially above the nozzle body, and a hold-down device may act on it. The retaining flange may rest on a cylinder head of the internal combustion engine. The retaining flanges extend over only portions of the periphery of the nozzle body.

SUBSTITUTE SPECIFICATION